Guadalupe, San Antonio, Mission, & Aransas Rivers and Mission, Copano, Aransas, & San Antonio Bays Basin and Bay Area Stakeholder Committee (GSA BBASC)

Technical Analyses of GSA BBEST Recommendations – Part 1: San Antonio River Project

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Presentation Format

1) Project Description
2) Project Hydrology: Firm Yield
3) Project Cost
4) Instream Ecology
5) Estuary Ecology

6) Questions / Clarifications

7) Discussion by the BBASC

San Antonio River Project

San Antonio River Project

- Diversions from San Antonio River @ Goliad
- Maximum Diversion Rate of 800 cfs
- 2 - 120-inch Diversion Pipelines
- 150,000 acft of Off-Channel Storage near Goliad
- Uniform Delivery of Firm Yield to SAWS Twin Oaks WTP

- Scenarios:
  - No Environmental Flow
  - Lyons Method
  - CCEFN
  - BBEST Recommendations

San Antonio River Project

- No Environmental Flow
  - Theoretical maximum firm yield of project subject to downstream senior water rights only.
- Lyons Method
  - TCEQ desktop environmental flow used in permitting. Uses 40% (Oct – Feb) and 60% (Mar – Sept) of monthly medians as flow criteria.
- Consensus Criteria for Environmental Flow Needs (CCEFN)
  - TWDB default 3-tiered (Medians, Quartiles, and 7Q2) flow criteria used in regional planning.
- BBEST Recommendations
  - Full flow regime recommendation of the GSA BBEST.

San Antonio River Project

- No Environmental Flow (cfs)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

- Lyons Method (cfs)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
178.0	165.0	273.0	285.0	312.0	319.0	172.0	175.0	259.0	181.0	162.0	165.0

- Consensus Criteria for Environmental Flow Needs (CCEFN) (cfs)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Median	294.2	306.6	306.8	305.8	371.0	346.3	241.9	199.4	239.9	258.0	283.1	288.9
Quartile	183.3	197.4	176.1	157.0	175.4	145.9	89.9	77.3	103.4	134.0	140.3	150.8
7Q2	77.0	77.0	77.0	77.0	77.0	77.0	77.0	77.0	77.0	77.0	77.0	77.0

San Antonio River Project

BBEST Recommendation

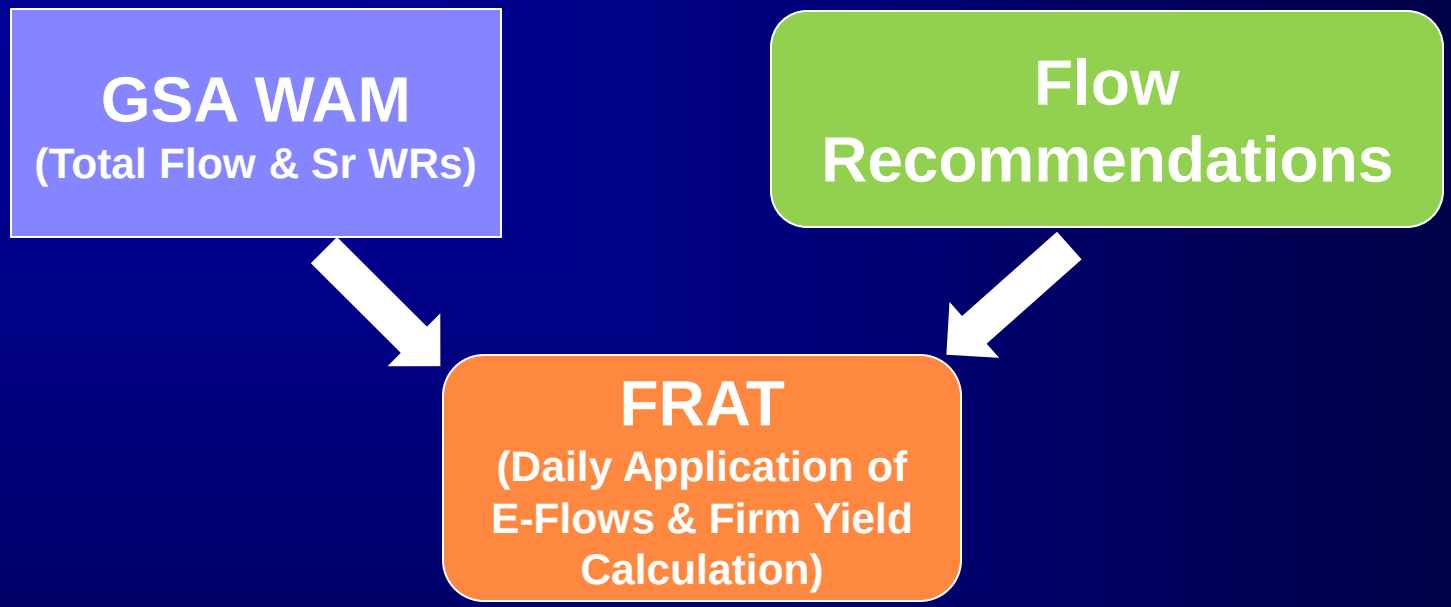
Overbank Flows	Qp: 23,600 cfs with Average Frequency 1 per 5 years Regressed Volume is 273,000 Duration Bound is 69										
	Qp: 10,600 cfs with Average Frequency 1 per 2 years Regressed Volume is 107,000 Duration Bound is 45										
	Qp: 7,680 cfs with Average Frequency 1 per year Regressed Volume is 73,500 Duration Bound is 38										
High Flow Pulses	Qp: 1,520 cfs with Average Frequency 1 per season Regressed Volume is 12,800 Duration Bound is 19			Qp: 3,540 cfs with Average Frequency 1 per season Regressed Volume is 30,000 Duration Bound is 24			Qp: 1,640 cfs with Average Frequency 1 per season Regressed Volume is 11,200 Duration Bound is 16			Qp: 2,320 cfs with Average Frequency 1 per season Regressed Volume is 17,600 Duration Bound is 19		
	Qp: 550 cfs with Average Frequency 2 per season Regressed Volume is 3,940 Duration Bound is 11			Qp: 1,570 cfs with Average Frequency 2 per season Regressed Volume is 11,300 Duration Bound is 16			Qp: 750 cfs with Average Frequency 2 per season Regressed Volume is 4,450 Duration Bound is 10			Qp: 780 cfs with Average Frequency 2 per season Regressed Volume is 5,070 Duration Bound is 11		
Base Flows (cfs)	290			280			220			270		
	200			180			150			200		
	140			130			120			130		
Subsistence Flows (cfs)	76			60			54			66		
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
	Winter			**Spring**			**Summer**			**Fall**		

Flow Levels	
	High (75th %ile)
	Medium (50th %ile)
	Low (25th %ile)
	Subsistence

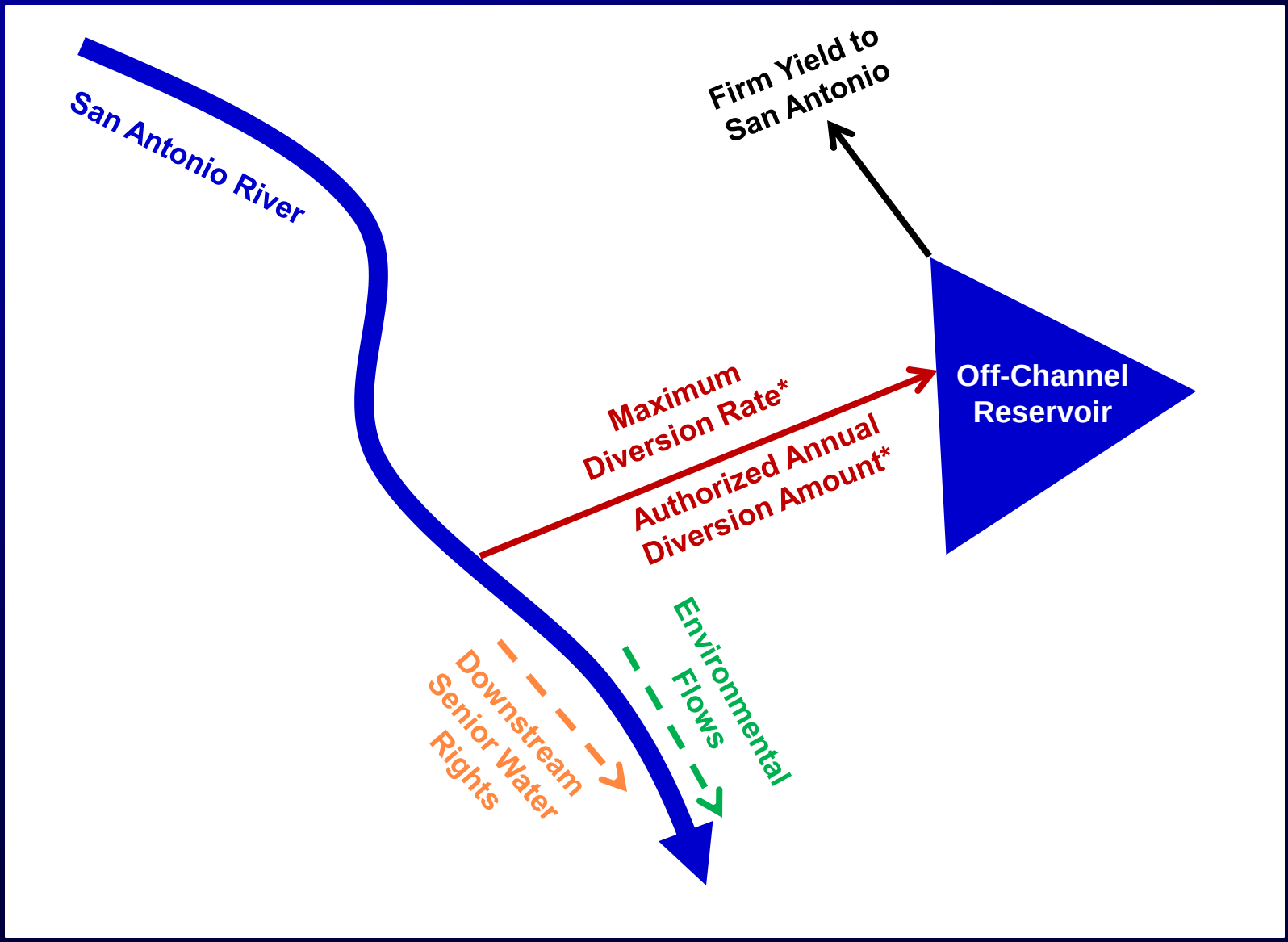
Notes:

1. Period of Record used: 1/1/1940 to 12/31/1969.
2. Volumes are in acre-feet and durations are in days.

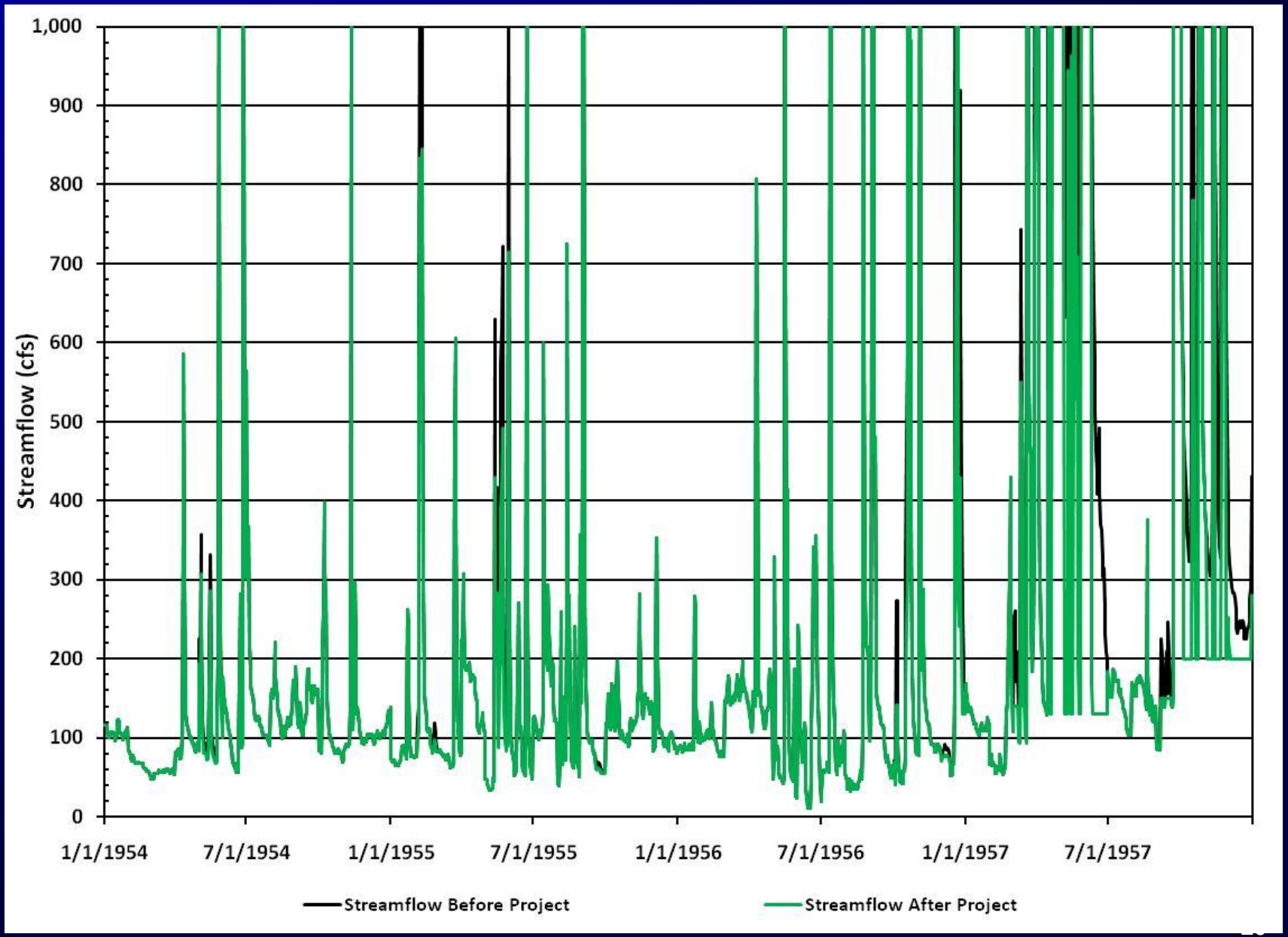
San Antonio River Project



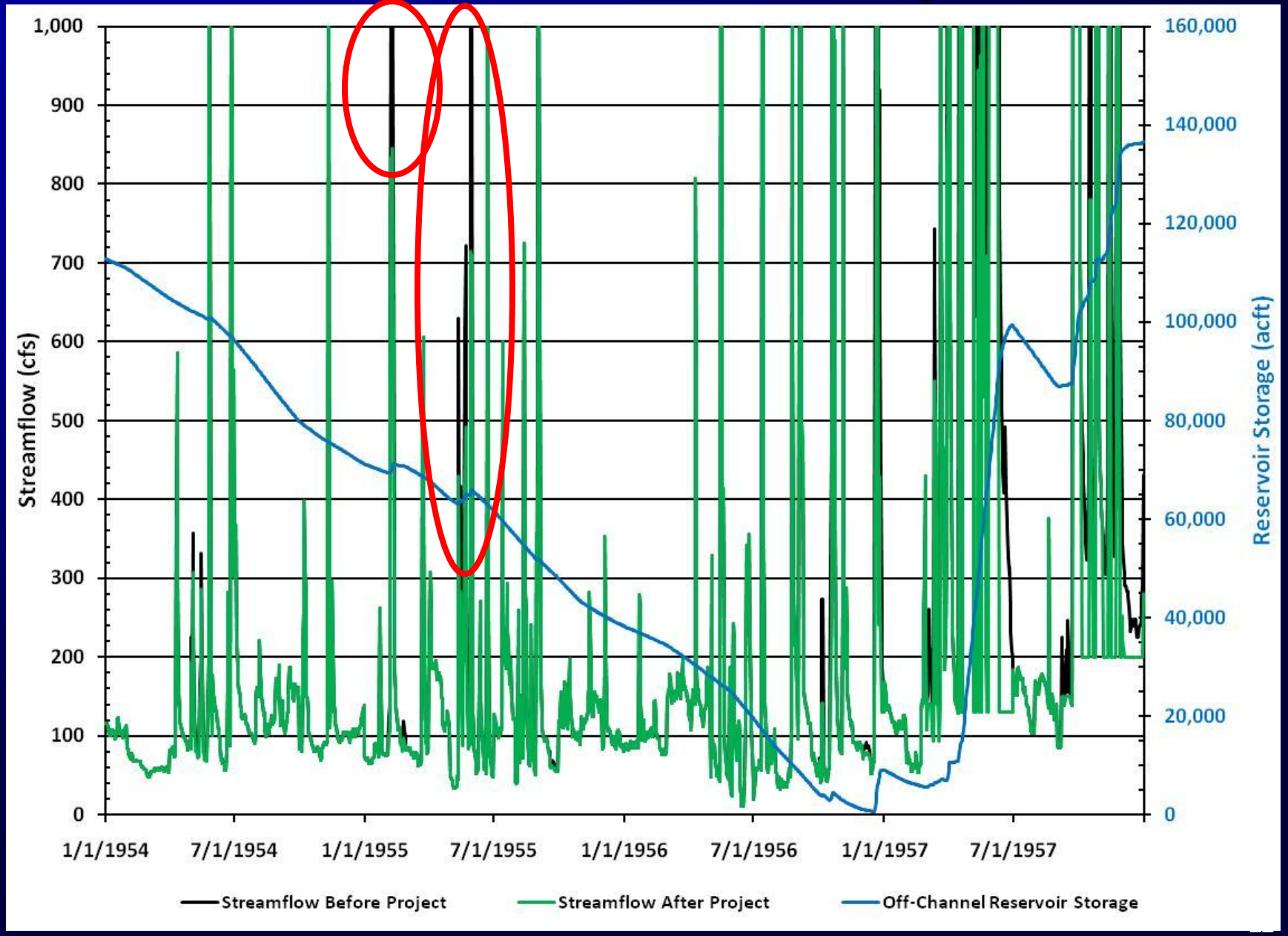
San Antonio River Project



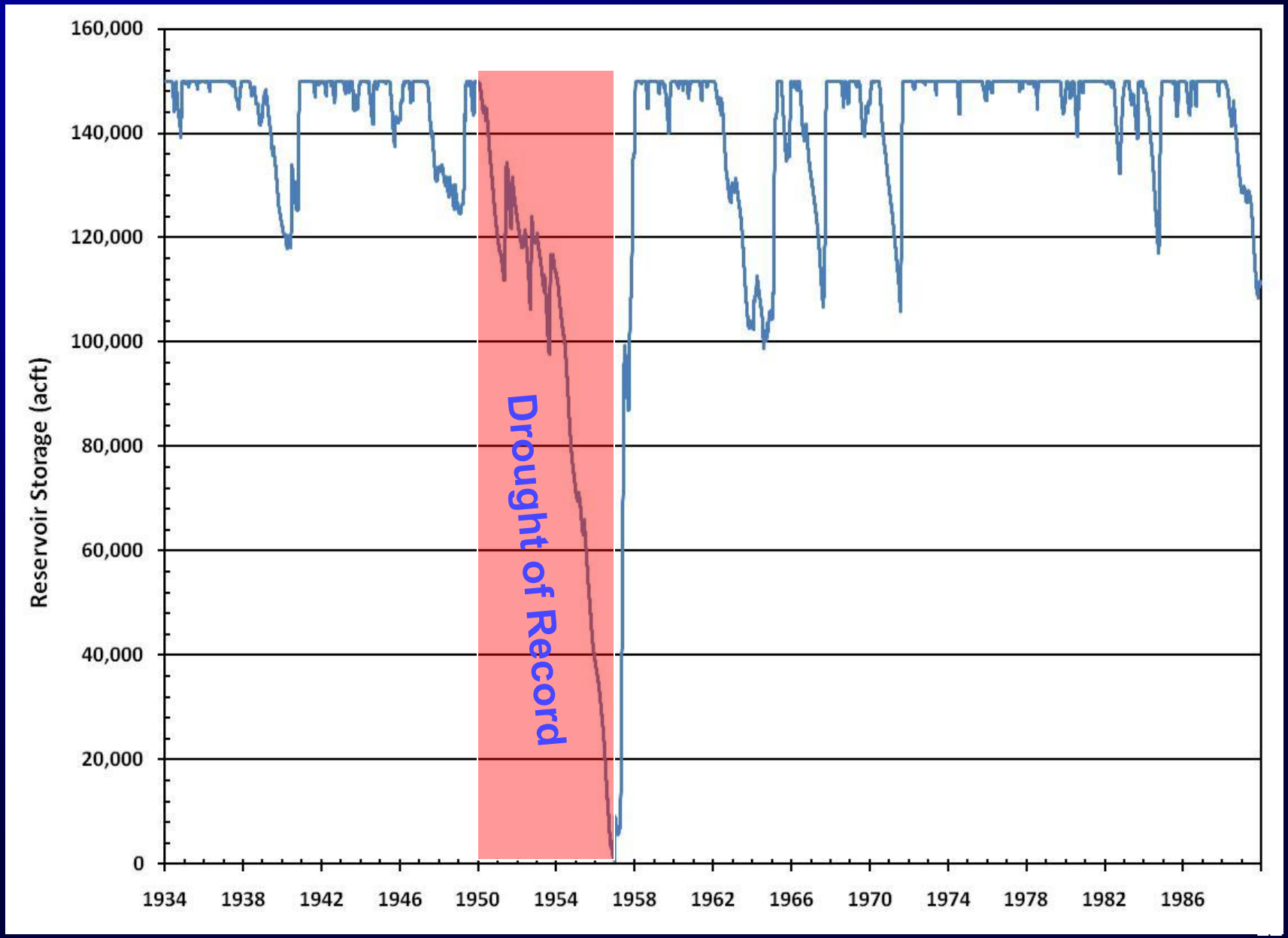
San Antonio River Project



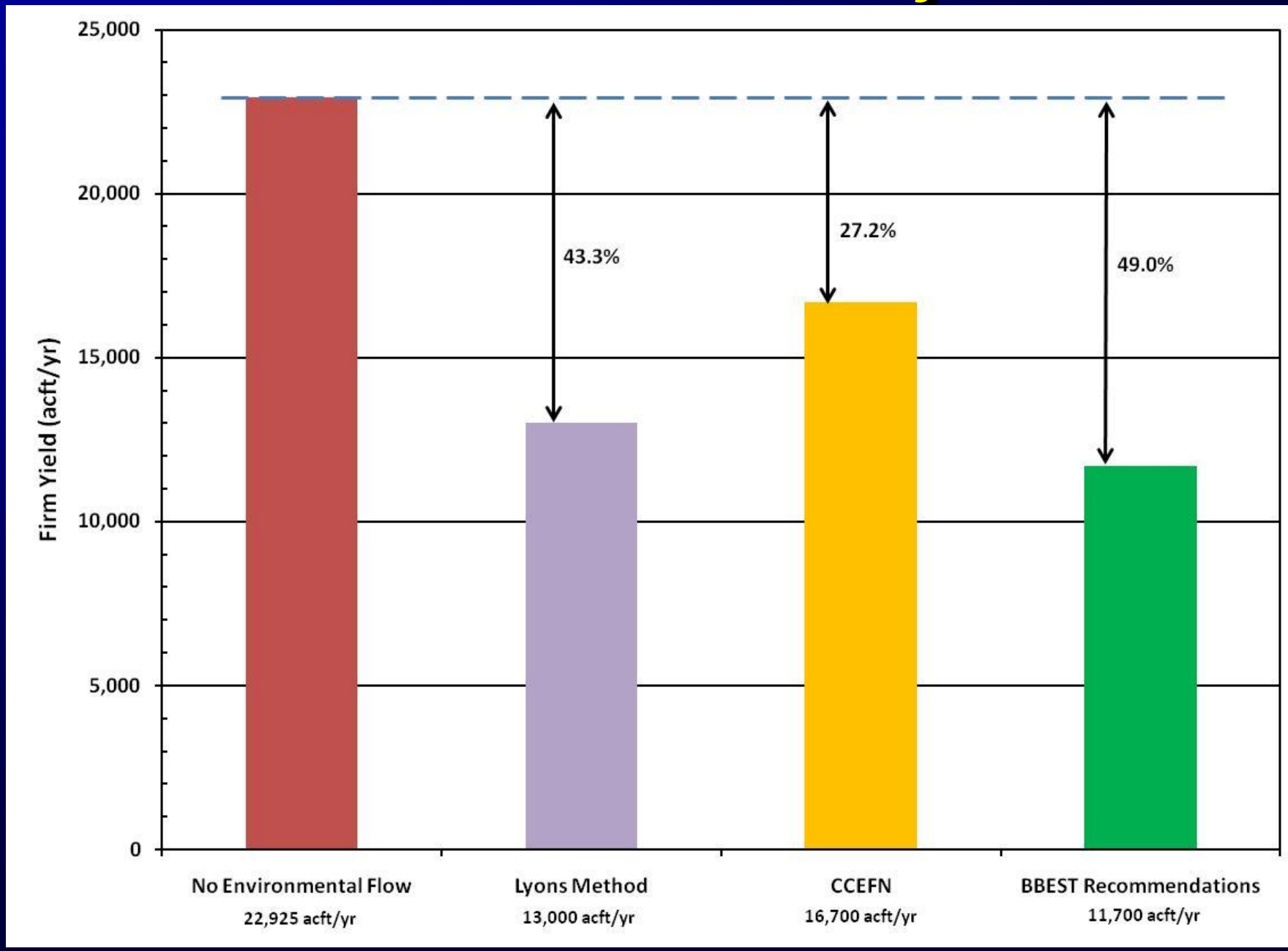
San Antonio River Project



San Antonio River Project



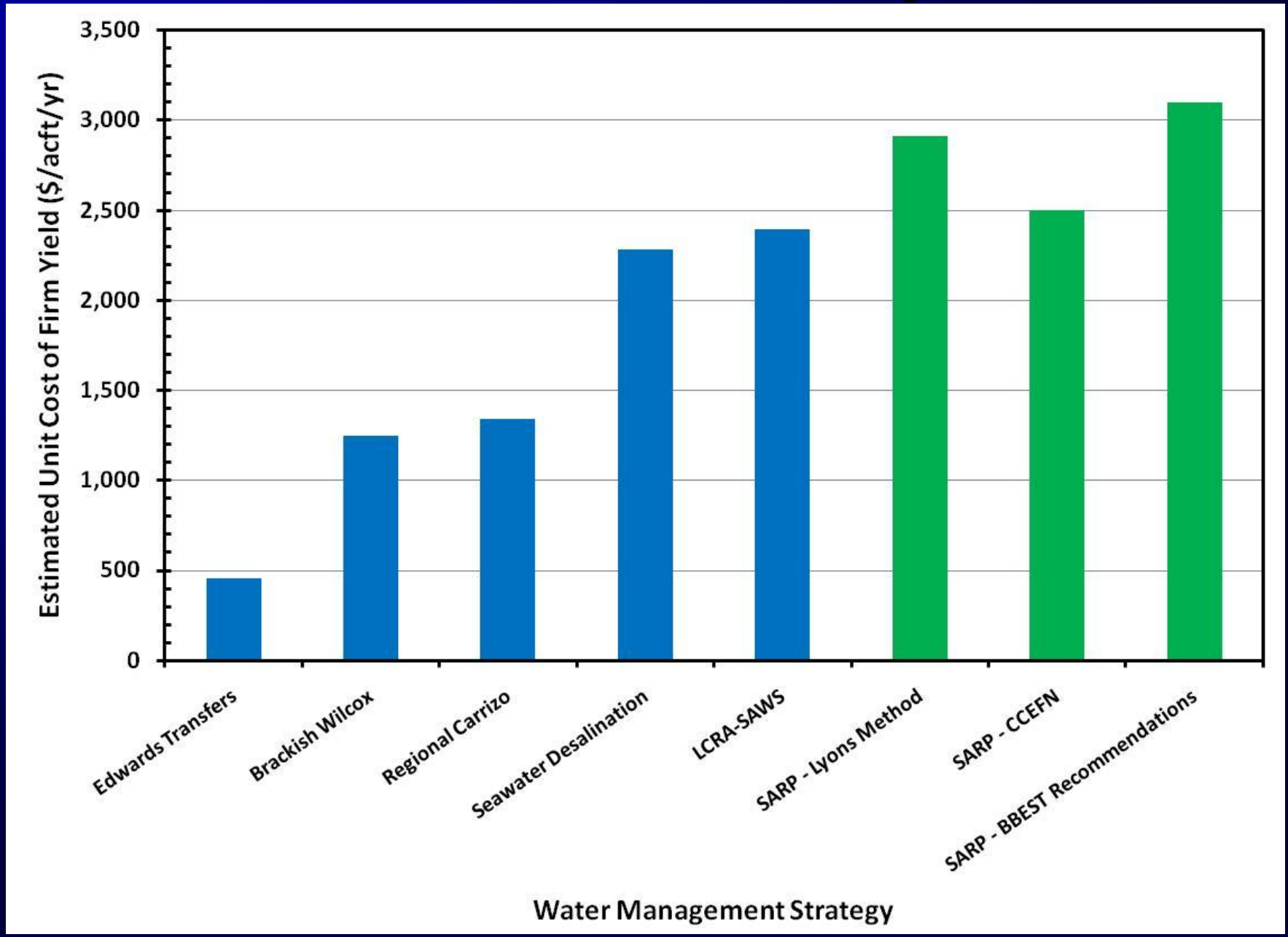
San Antonio River Project



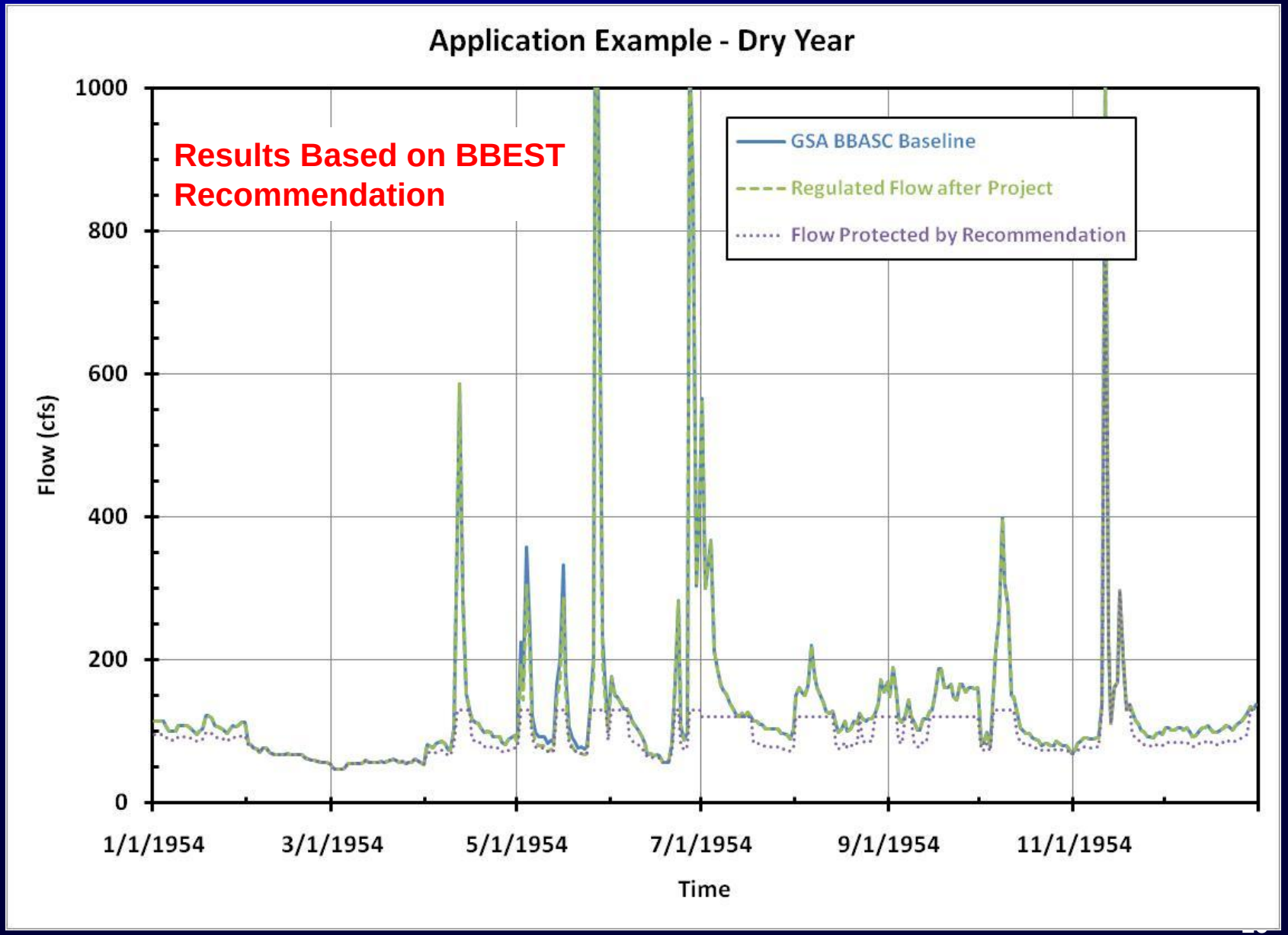
San Antonio River Project

	No Environmental Flow	Lyons Method	CCEFN	BBEST Recommendation
Available Project Yield (acft/yr)	22,925	13,000	16,700	11,700
Raw Water at Reservoir				
Total Project Cost	$205,650,000	$205,650,000	$205,650,000	$205,650,000
Total Annual Cost	$17,678,000	$17,558,000	$17,570,000	$17,461,000
Annual Cost of Raw Water ($ per acft)	$771	$1,351	$1,052	$1,492
Annual Cost of Raw Water ($ per 1,000 gallons)	$2.37	$4.14	$3.23	$4.58
Treated Water Delivered				
Total Project Cost	$455,737,000	$372,816,000	$403,471,000	$364,407,000
Total Annual Cost	$47,912,000	$37,814,000	$41,760,000	$36,236,000
Annual Cost of Water ($ per acft)	$2,090	$2,909	$2,501	$3,097
Annual Cost of Water ($ per 1,000 gallons)	$6.41	$8.93	$7.67	$9.50

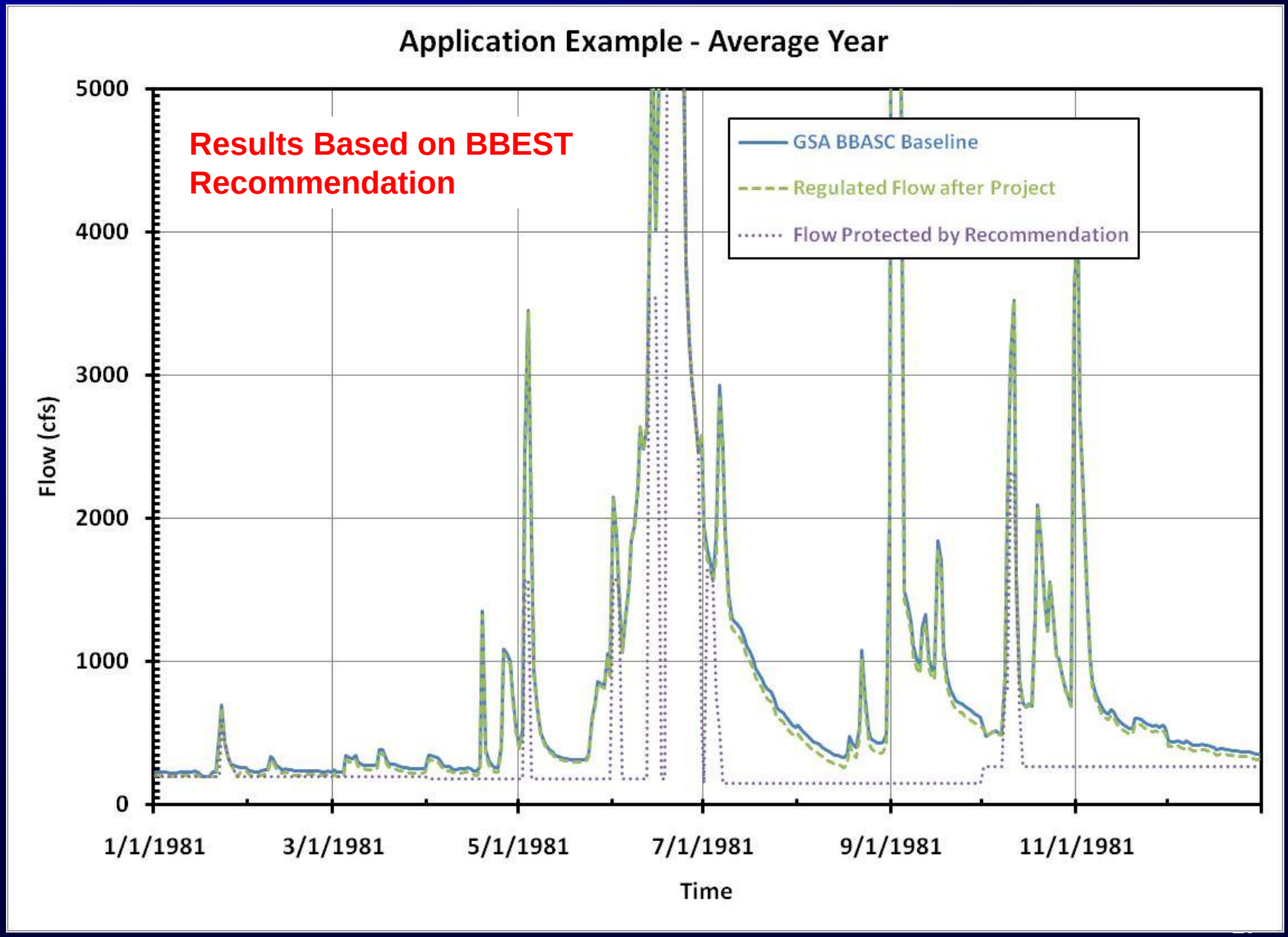
San Antonio River Project



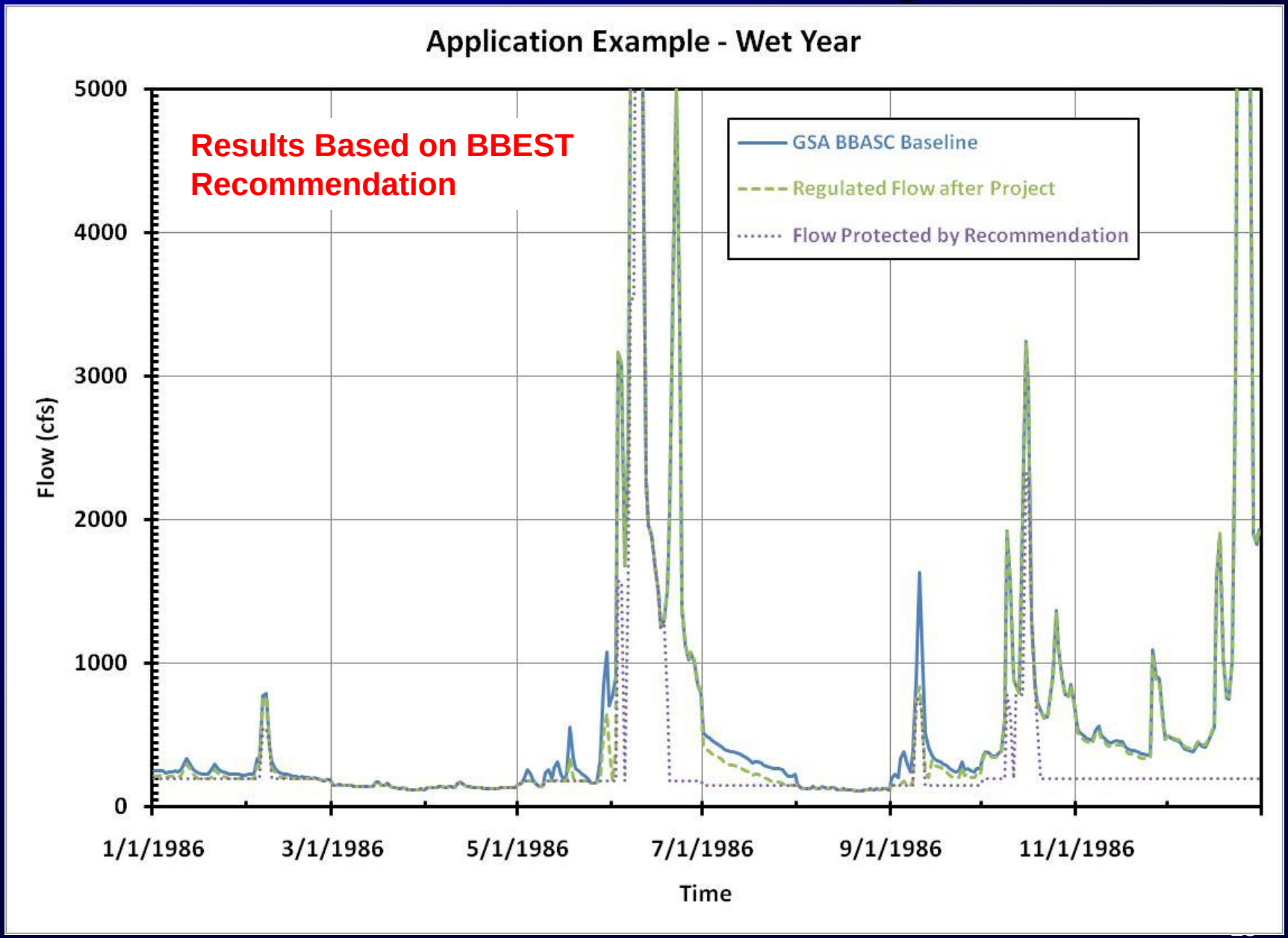
San Antonio River Project



San Antonio River Project



San Antonio River Project



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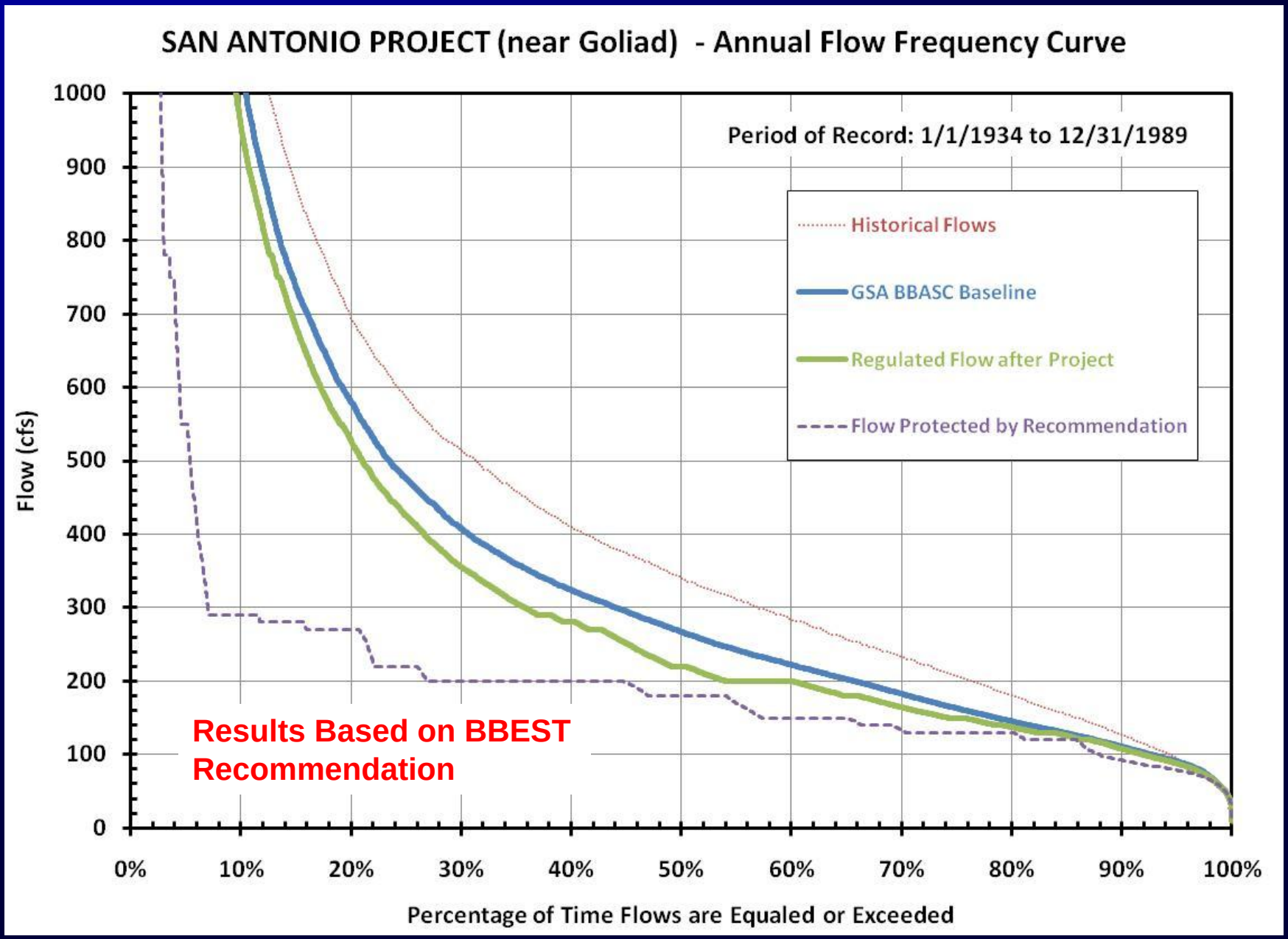

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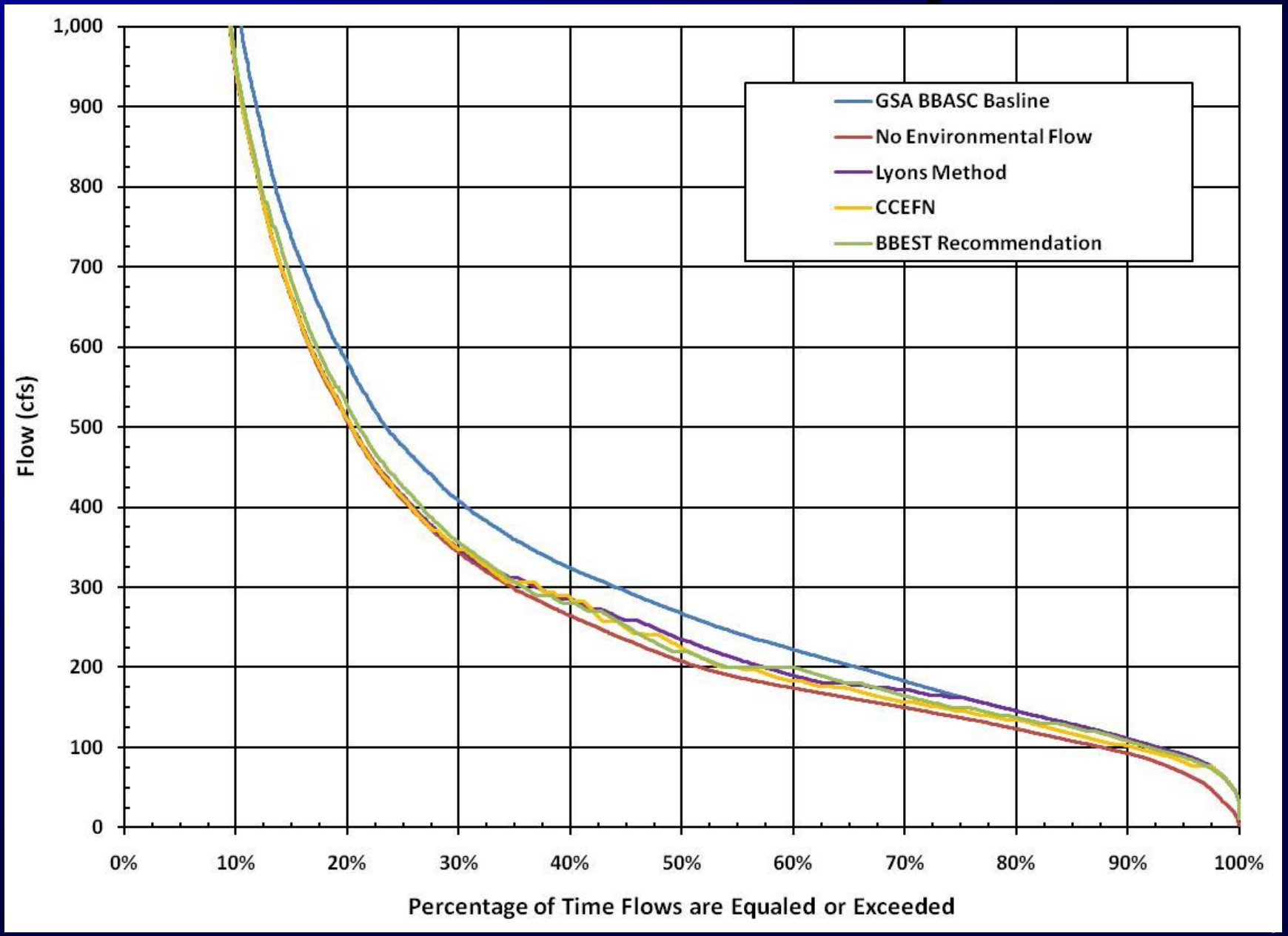
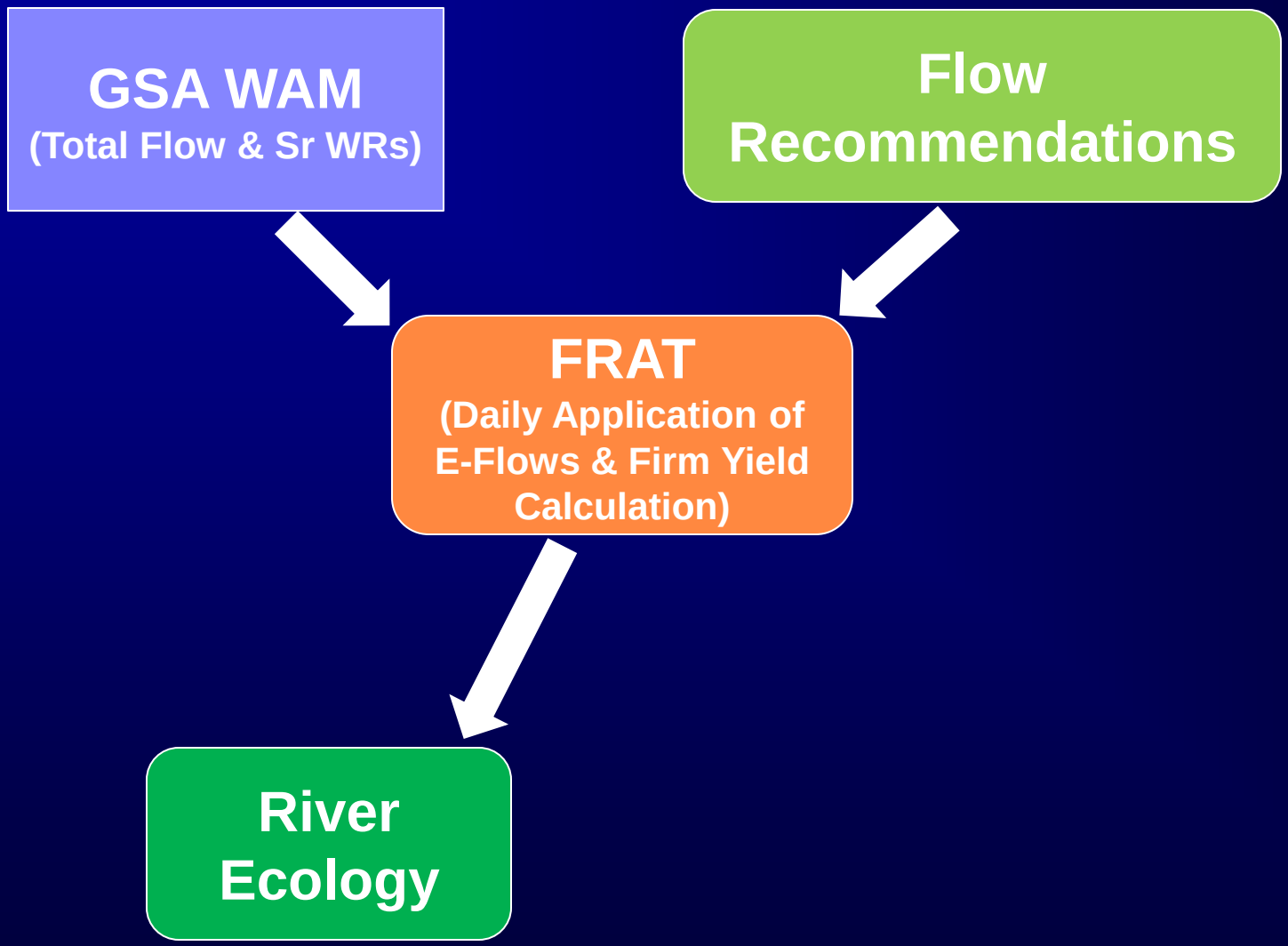


San Antonio River Project

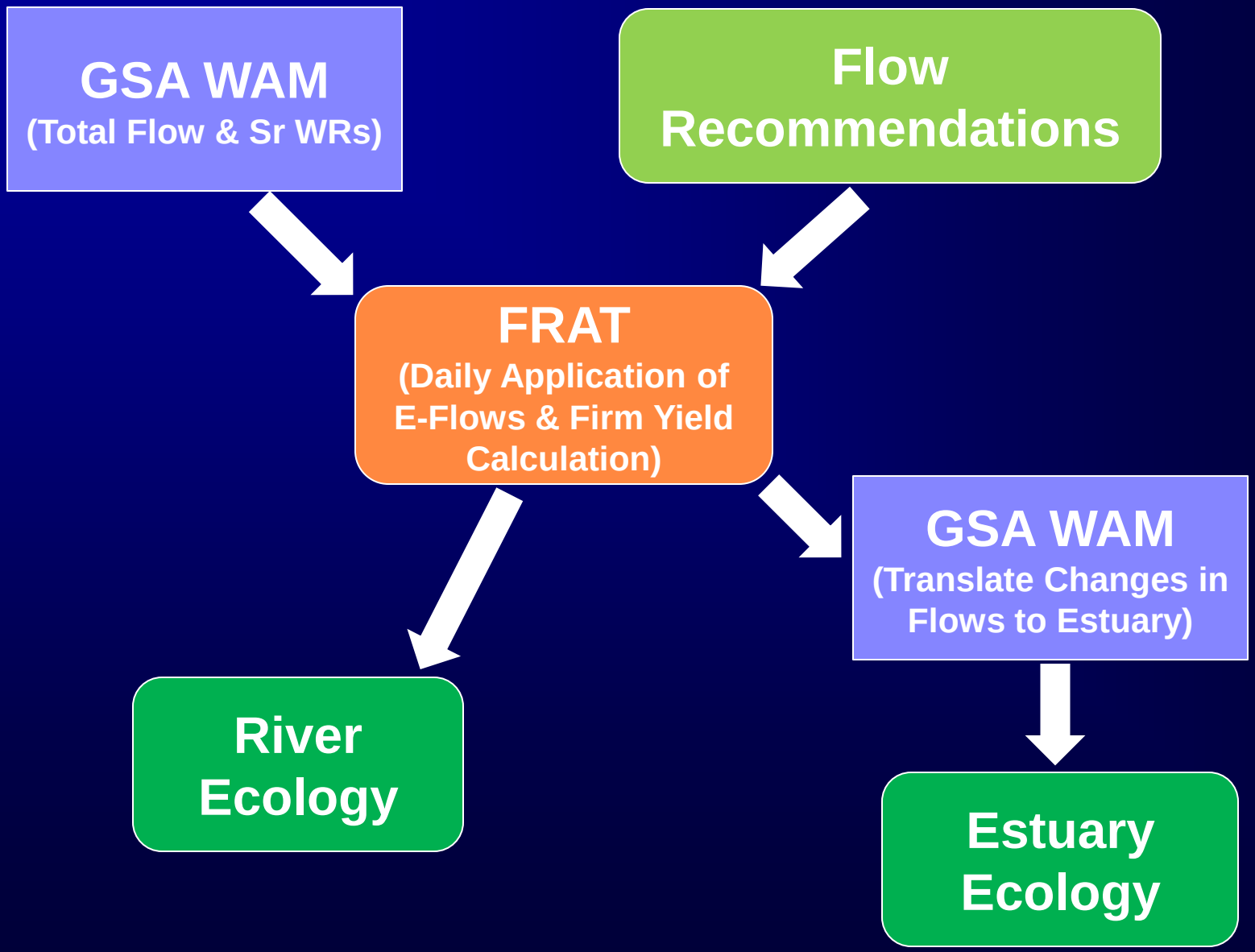


San Antonio River Project

BIO-WEST

Presentation

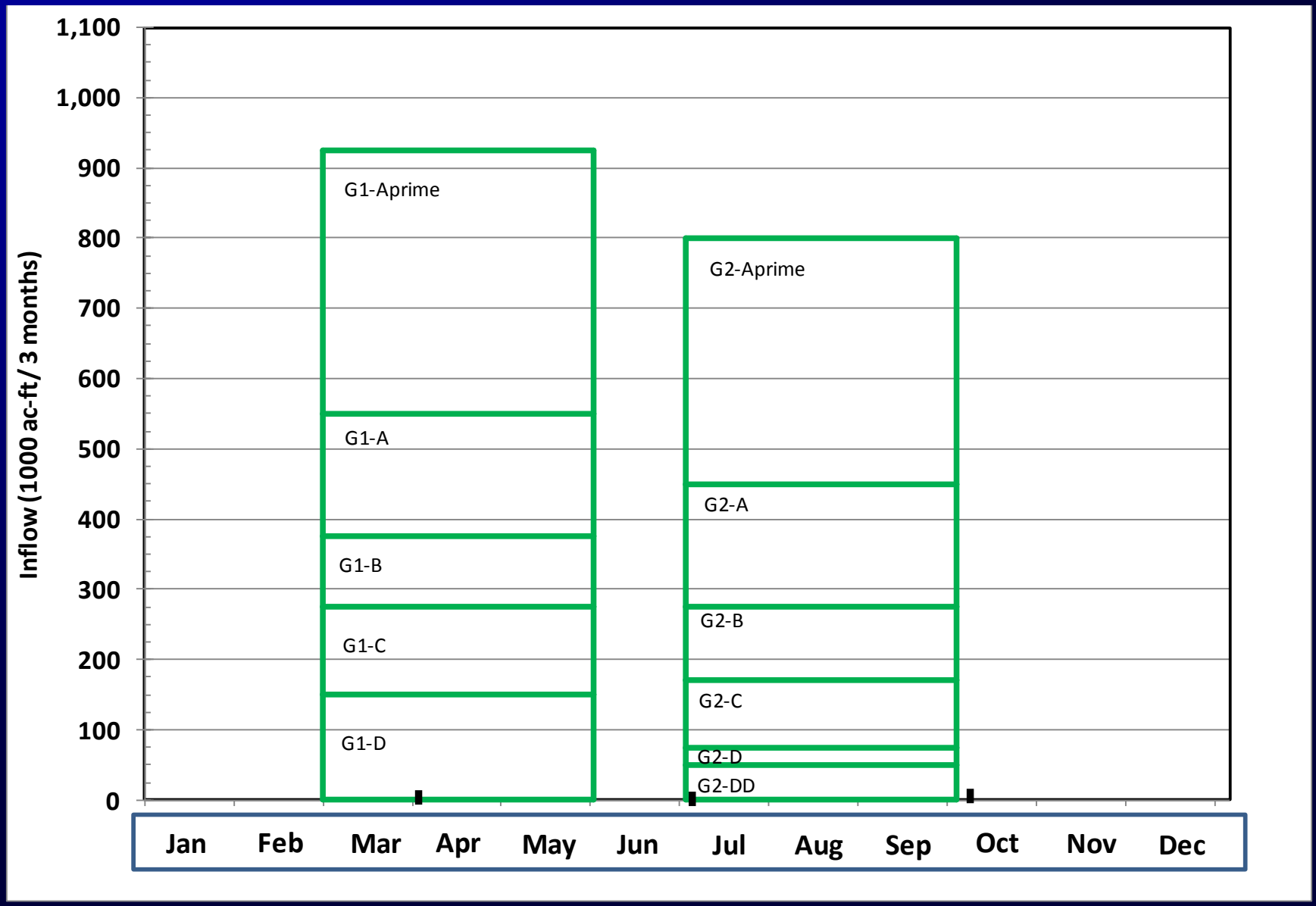
San Antonio River Project



San Antonio River Project

Orientation & Baseline Discussion

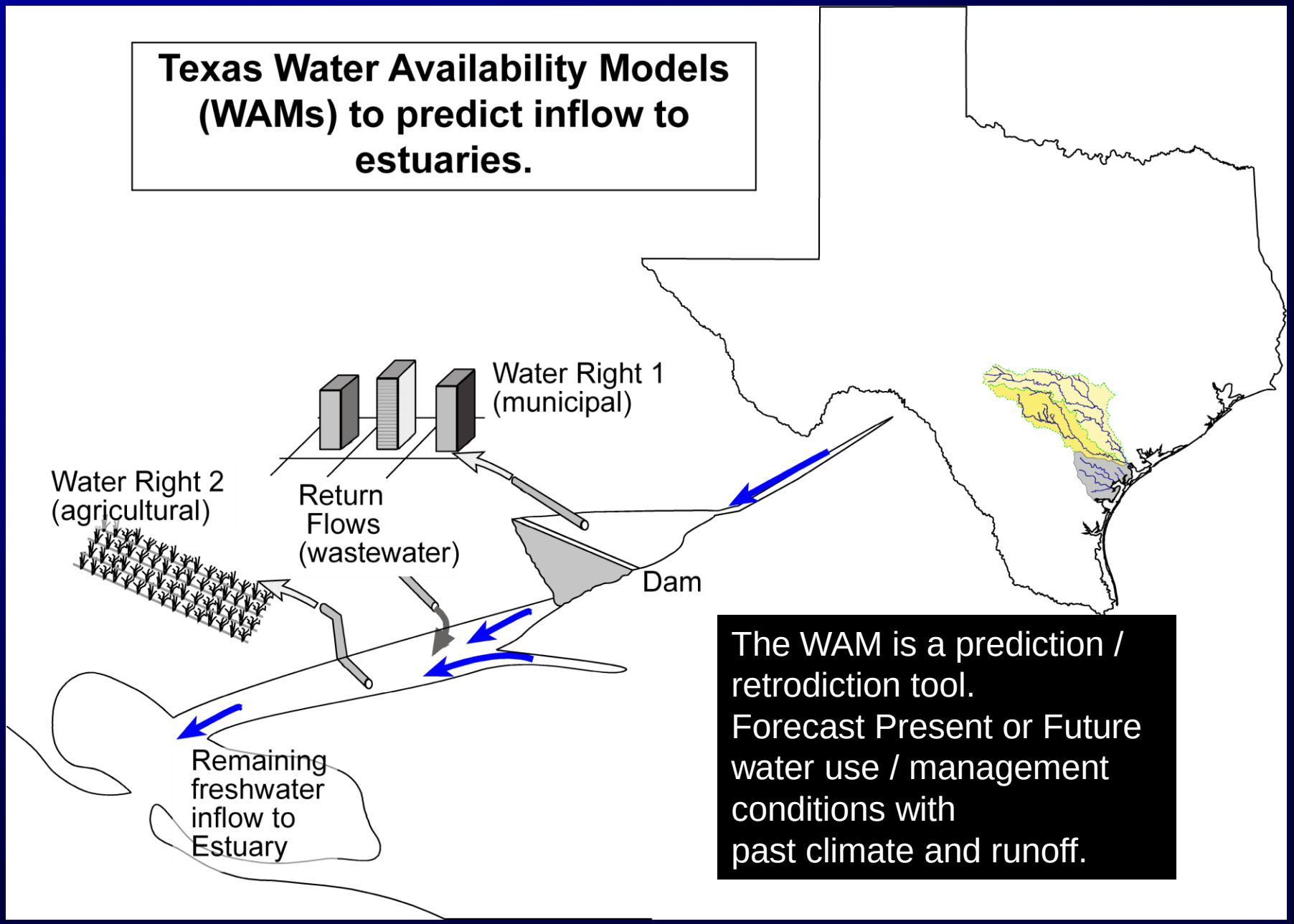
BBEST Guadalupe Estuary criteria: spring & summer



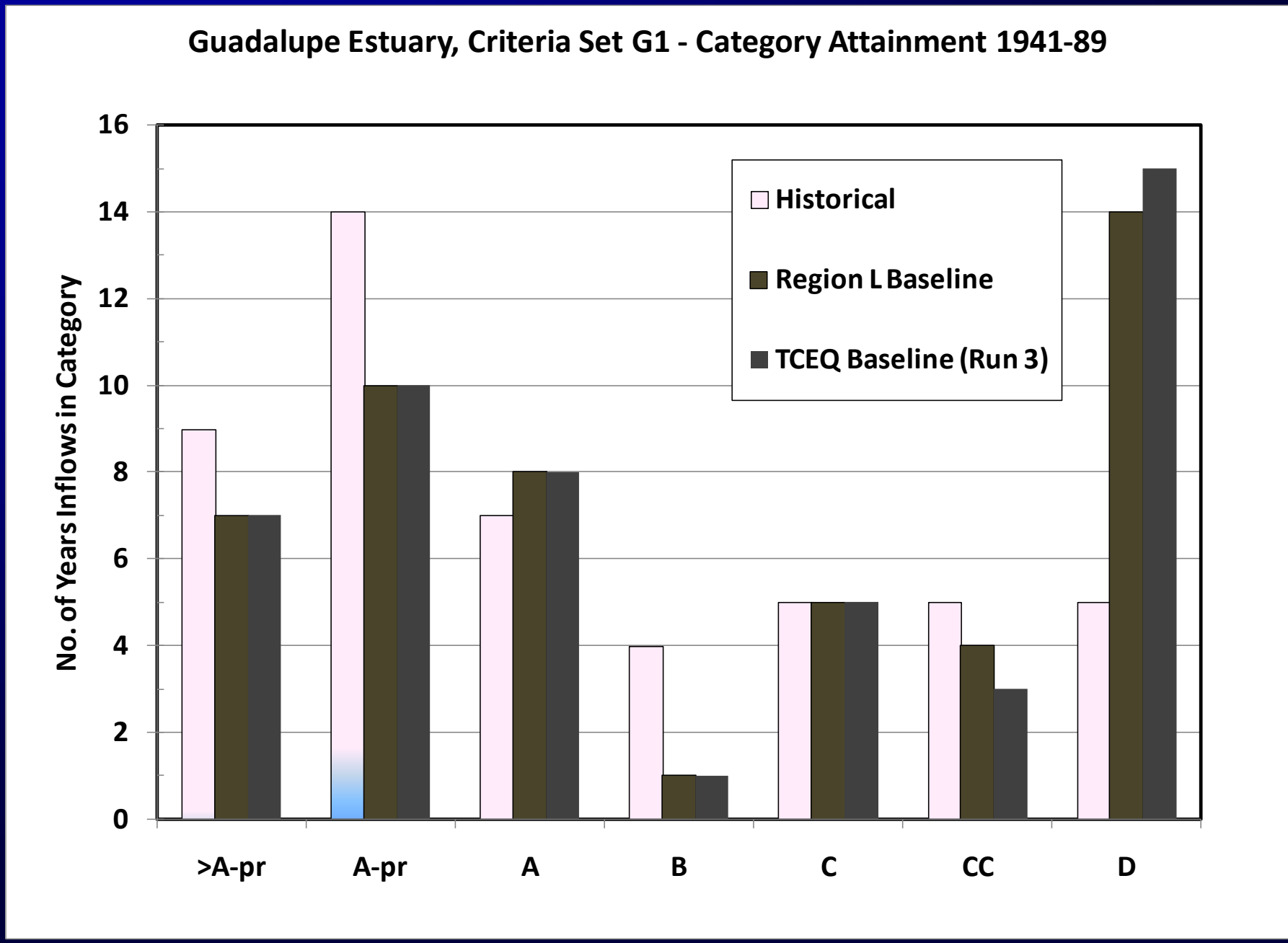
Time Series of Inflows to Guadalupe Estuary Scenarios utilized (@ 04/19) – principal characteristics

	Natural	Historical	Present	Region L	TCEQ Run3
Surface water use/demands	0	historical, transient	max. last 10yr, constant	Full use, constant	Full use, constant
WW Returns	0	historical, transient	min. last 5 yr, constant	recent (’06) levels, constant	0
Edwards Aq. use / mgmt.	0	historical, transient	SB 3 , constant w. drought mgmt.	SB 3 , constant w. drought mgmt.	SB 3 , constant w. drought mgmt.
Data source	model	data	model	model	model
Period of record	1934-1989	1941 - 2009	1934-1989	1934-1989	1934-1989

Texas Water Availability Models (WAMs) to predict inflow to estuaries.



The WAM is a prediction / retrodiction tool.
Forecast Present or Future water use / management conditions with
past climate and runoff.


Guadalupe Estuary, Criteria Set G1 - Category Attainment 1941-89
No. of Years Inflows in Category
16
14
12
10
8
6
4
2
0
Historical
Region L Baseline
TCEQ Baseline (Run 3)
>A-pr
A-pr
A
B
C
CC
D

Summary – Attainment of G1 Springtime Criteria (Rangia)

Counts	Criteria G1 Attainment (no. years)							
Scenario	>A-pr	A-pr	A	B	C	CC	D	sum
Natural	9	15	7	6	3	6	3	49
Historical	9	14	7	4	5	5	5	49
Present	8	14	4	5	5	5	8	49
Region L Baseline	7	10	8	1	5	4	14	49
TCEQ Baseline (Run 3)	7	10	8	1	5	3	15	49
see Tables 4.5-3 & 4.5-6		>12%	>12%				<=9%	

Attain. - Singles	Single G1 criteria attainment (% of yrs.)						
Scenario	>A-pr	A-pr	A	B	C	CC	D
Natural		30.6%	14.3%	12.2%	6.1%	12.2%	6.1%
Historical		28.6%	14.3%	8.2%	10.2%	10.2%	10.2%
Present		28.6%	8.2%	10.2%	10.2%	10.2%	16.3%
Region L Baseline		20.4%	16.3%	2.0%	10.2%	8.2%	28.6%
TCEQ Baseline (Run 3)		20.4%	16.3%	2.0%	10.2%	6.1%	30.6%
see Table 4.5-3			>17%		>=19%	<=2/3	

Attain. - Joints	Joint G1 criteria attainment (% of yrs. and fractions)						
Scenario	>A-pr		A & B		C & CC	frac. CC	
Natural			26.5%		18.4%	66.7%	
Historical			22.4%		20.4%	50.0%	
Present			18.4%		20.4%	50.0%	
Region L Baseline			18.4%		18.4%	44.4%	
TCEQ Baseline (Run 3)			18.4%		16.3%	37.5%	

Color coding convention
-OK, met criteria
-Near miss. (rounding; p-o-record)
-Not met, but departure not great
-Very bad

Time Series of Inflows to Guadalupe Estuary Scenarios utilized (@ 04/19) – principal characteristics

	Natural	Historical	Present	Region L	TCEQ Run3
Surface water use/demands	0	historical, transient	max. last 10yr, constant	Full use, constant	Full use, constant
WW Returns	0	historical, transient	min. last 5 yr, constant	recent ('06) levels, constant	0
Edwards Aq. use / mgmt.	0	historical, transient	SB 3 , constant w. drought mgmt.	SB 3 , constant w. drought mgmt.	SB 3 , constant w. drought mgmt.
Data source	model	data	model	model	model
Period of record	1934-1989	1941 - 2009	1934-1989	1934-1989	1934-1989

Summary – Attainment of G1 Springtime Criteria (Rangia)

Counts	Criteria G1 Attainment (no. years)							
Scenario	>A-pr	A-pr	A	B	C	CC	D	sum
Historical	9	14	7	4	5	5	5	49
Present	8	14	4	5	5	5	8	49
Region L Baseline; BBEST	7	10	8	1	5	4	14	49
Region L Baseline; BBASC	7	10	8	3	3	4	14	49
TCEQ Baseline; (Run 3)	7	10	8	1	5	3	15	49
see Tables 4.5-3 & 4.5-6		>12%	>12%				<=9%	

Attain. - Singles	Single G1 criteria attainment (% of yrs.)						
Scenario	>A-pr	A-pr	A	B	C	CC	D
Natural		30.6%	14.3%	12.2%	6.1%	12.2%	6.1%
Historical		28.6%	14.3%	8.2%	10.2%	10.2%	10.2%
Present		28.6%	8.2%	10.2%	10.2%	10.2%	16.3%
Region L Baseline; BBEST		20.4%	16.3%	2.0%	10.2%	8.2%	28.6%
Region L Baseline; BBASC		20.4%	16.3%	6.1%	6.1%	8.2%	28.6%
TCEQ Baseline; (Run 3)		20.4%	16.3%	2.0%	10.2%	6.1%	30.6%
see Table 4.5-3			>17%		>=19%	<=2/3	

Attain. - Joints	Joint G1 criteria attainment (% of yrs. and fractions)						
Scenario	>A-pr		A & B		C & CC	frac. CC	
Natural			26.5%		18.4%	66.7%	
Historical			22.4%		20.4%	50.0%	
Present			18.4%		20.4%	50.0%	
Region L Baseline; BBEST			18.4%		18.4%	44.4%	
Region L Baseline; BBASC			22.4%		14.3%	57.1%	
TCEQ Baseline; (Run 3)			18.4%		16.3%	37.5%	

1961: 270 (4/19) -> 279 (BBASC);
1983: 268 (4/19) -> 276 (BBASC)
B – C breakpoint = 275

Both moved from C up to B

Color coding convention	
	-OK, met criteria
	-Near miss. (rounding; p-o-record)
	-Not met, but departure not great
	-Very bad

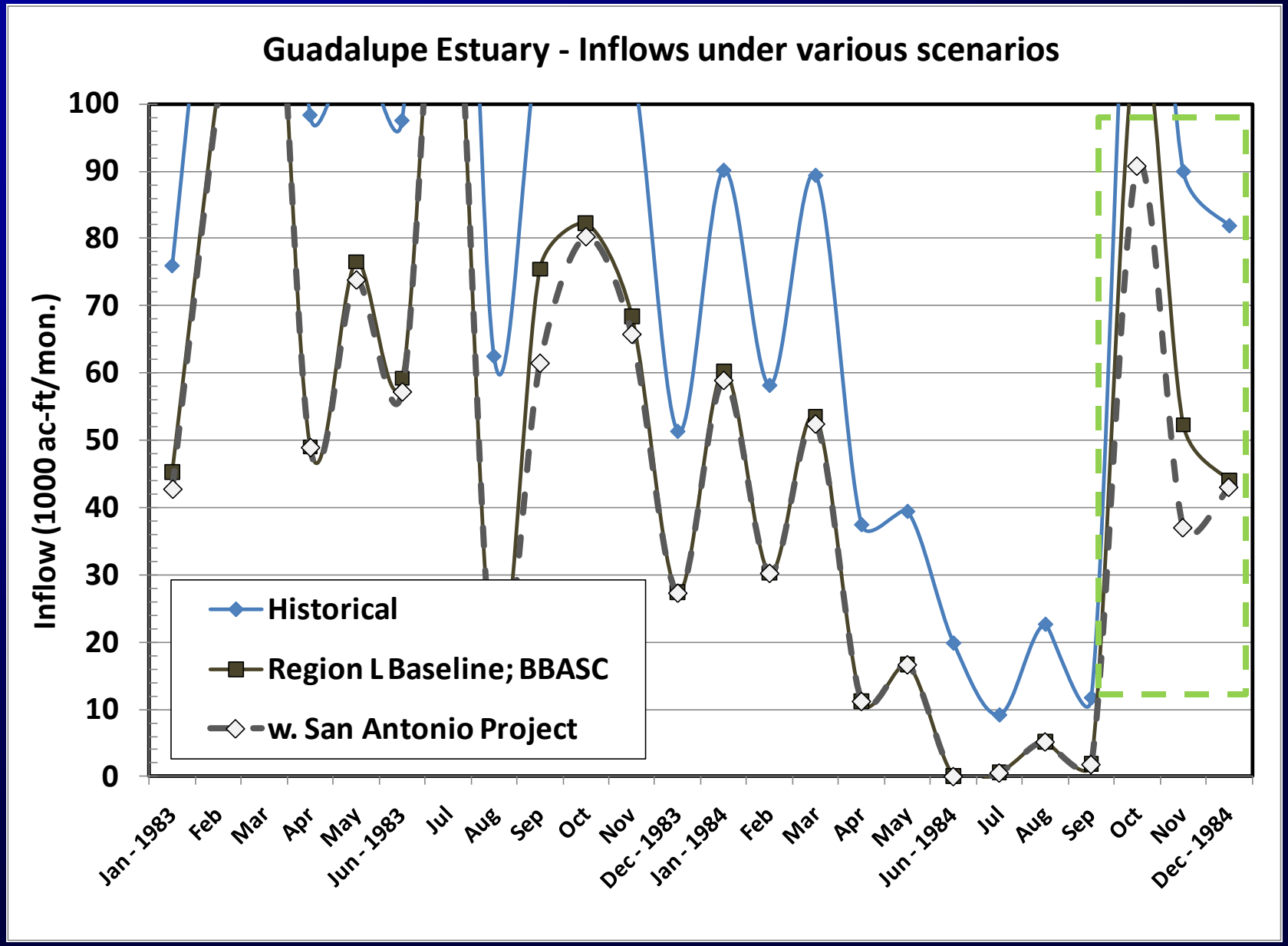
Summary – Attainment of G2 Summer Criteria (oysters)

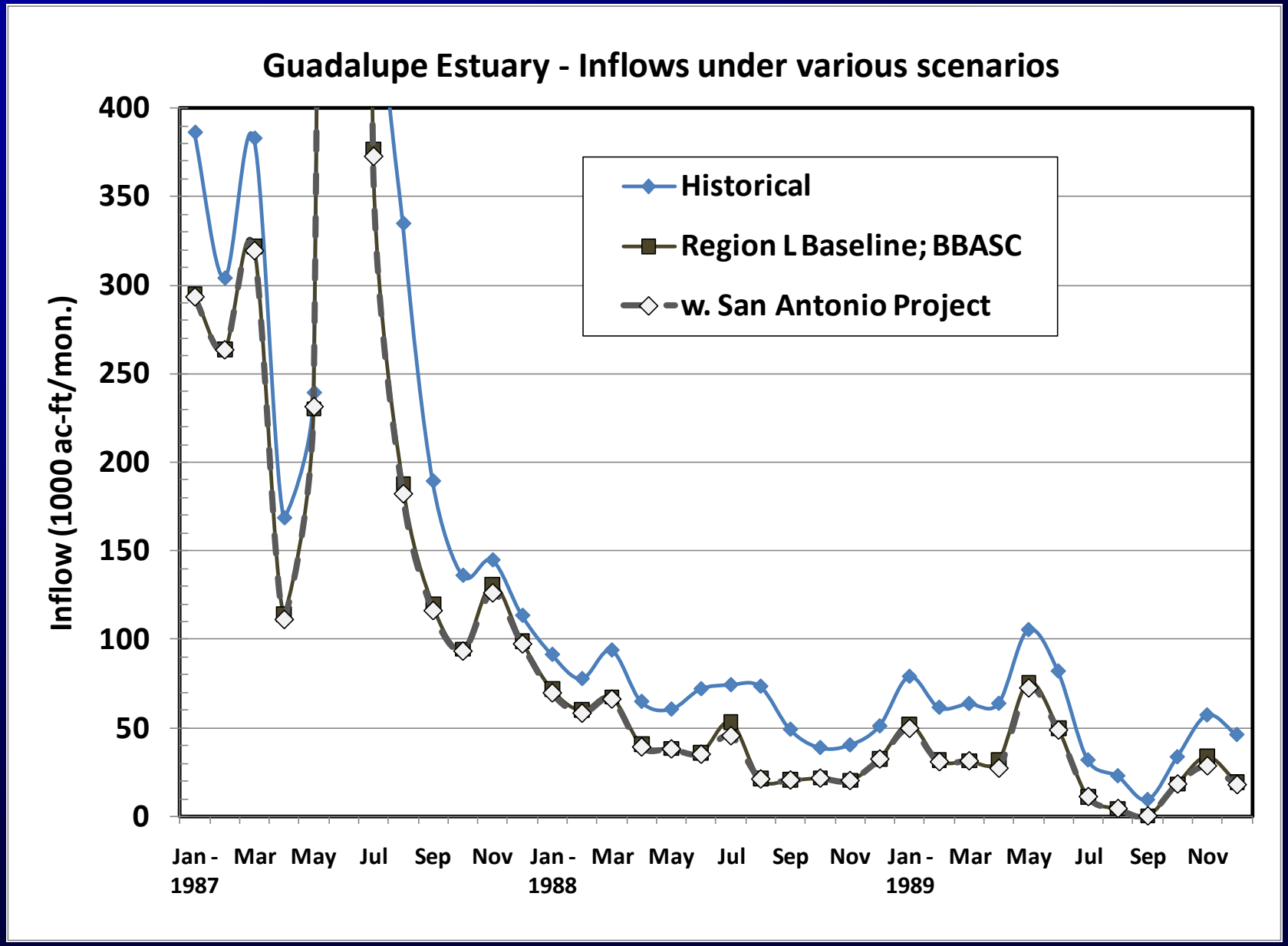
Counts	Criteria G2 Attainment (no. years)								
Scenario	>A-pr	A-pr	A	B	C	CC	D	DD	sum
Natural	9	11	15	7	3	2	2	0	49
Historical	8	11	11	8	5	1	1	4	49
Present	5	11	8	10	8	1	1	5	49
Region L Baseline; BBEST	4	8	8	8	6	4	4	7	49
Region L Baseline; BBASC	4	8	8	8	7	3	3	8	49
TCEQ Baseline; (Run 3)	4	6	9	8	6	4	3	9	49
see Tables 4.5-2; 4.5-4		>12%	>17%				<=6%		
Attain. - Singles	Single G2 criteria attainment (% of yrs.)								
Scenario	>A-pr	A-pr	A	B	C	CC	D	DD	
Natural		22.4%	30.6%	14.3%	6.1%	4.1%	4.1%	0.0%	
Historical		22.4%	22.4%	16.3%	10.2%	2.0%	2.0%	8.2%	
Present		22.4%	16.3%	20.4%	16.3%	2.0%	2.0%	10.2%	
Region L Baseline; BBEST		16.3%	16.3%	16.3%	12.2%	8.2%	8.2%	14.3%	
Region L Baseline; BBASC		16.3%	16.3%	16.3%	14.3%	6.1%	6.1%	16.3%	
TCEQ Baseline; (Run 3)		12.2%	18.4%	16.3%	12.2%	8.2%	6.1%	18.4%	
see Table 4.5-2			>=30%		>10%	<=1/6	<=9%		
Attain. - Joints	Joint G2 criteria attainment (% of yrs. and fractions)								
Scenario	>A-pr		A & B		C & CC	frac. CC	D & DD		
Natural			44.9%		10.2%	40.0%	4.1%		
Historical			38.8%		12.2%	16.7%	10.2%		
Present			36.7%		18.4%	11.1%	12.2%		
Region L Baseline; BBEST			32.7%		20.4%	40.0%	22.4%		
Region L Baseline; BBASC			32.7%		20.4%	30.0%	22.4%		
TCEQ Baseline; (Run 3)			34.7%		20.4%	40.0%	24.5%		

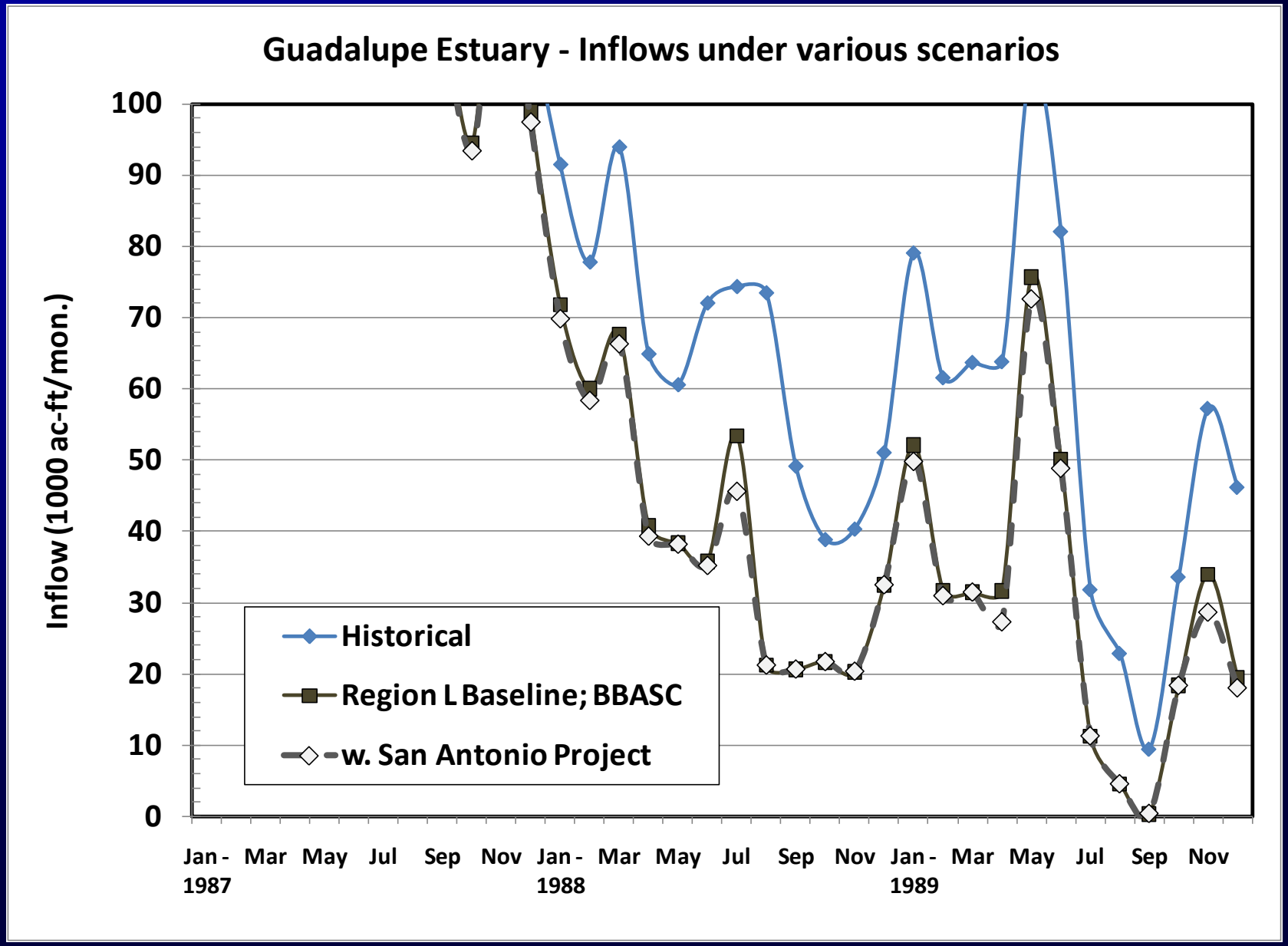
1947 Jun: 48 (4/19) -> 53 (BBASC);
CC – C breakpoint, June = 50
1947 moved from CC up to C

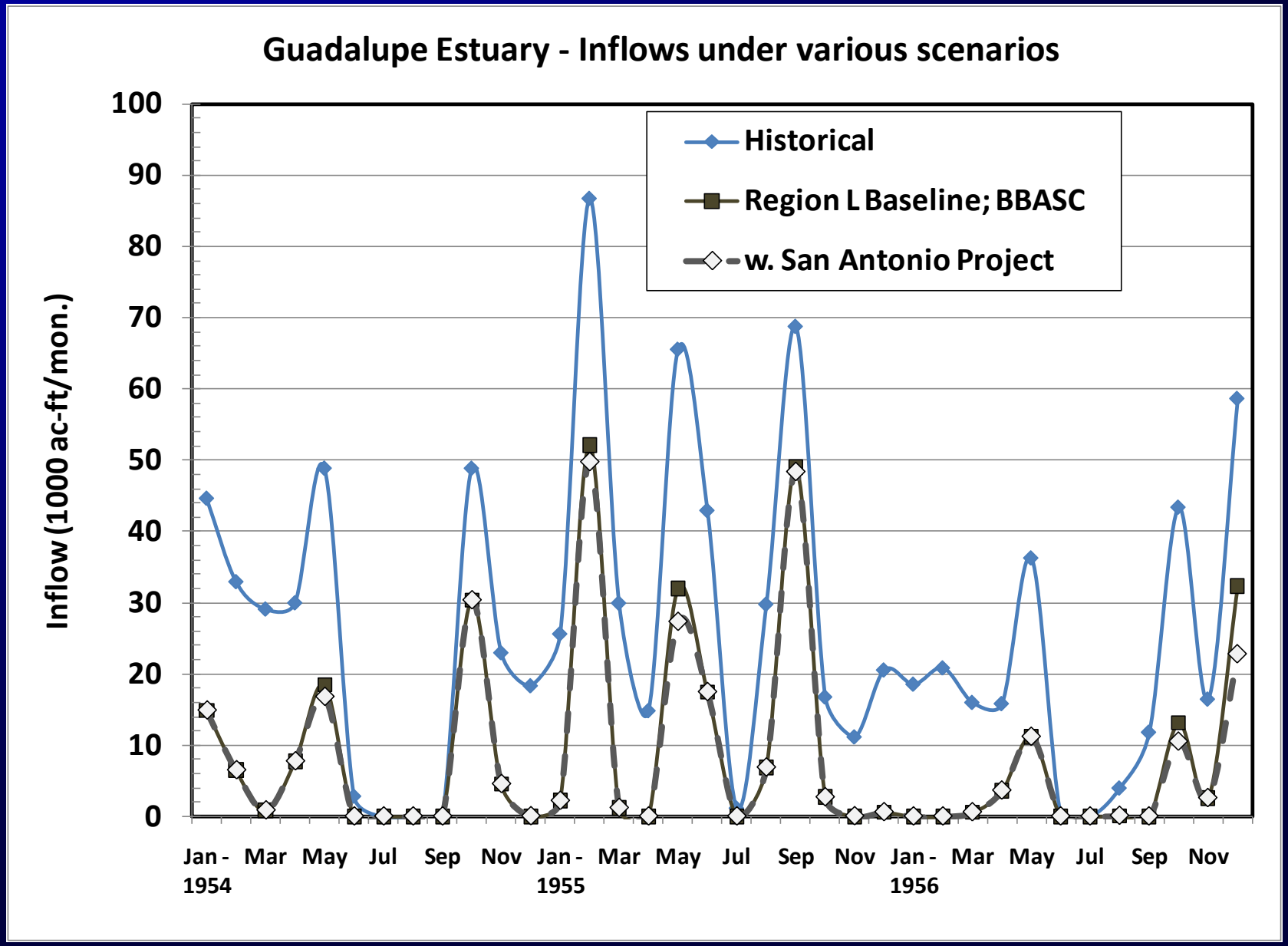
1965, Jul-Sep: 59 (4/19) -> 50 (BBASC)
D- DD breakpoint, Jul-Sep sum = 50
1965 moved from D to DD

San Antonio River Project Slides

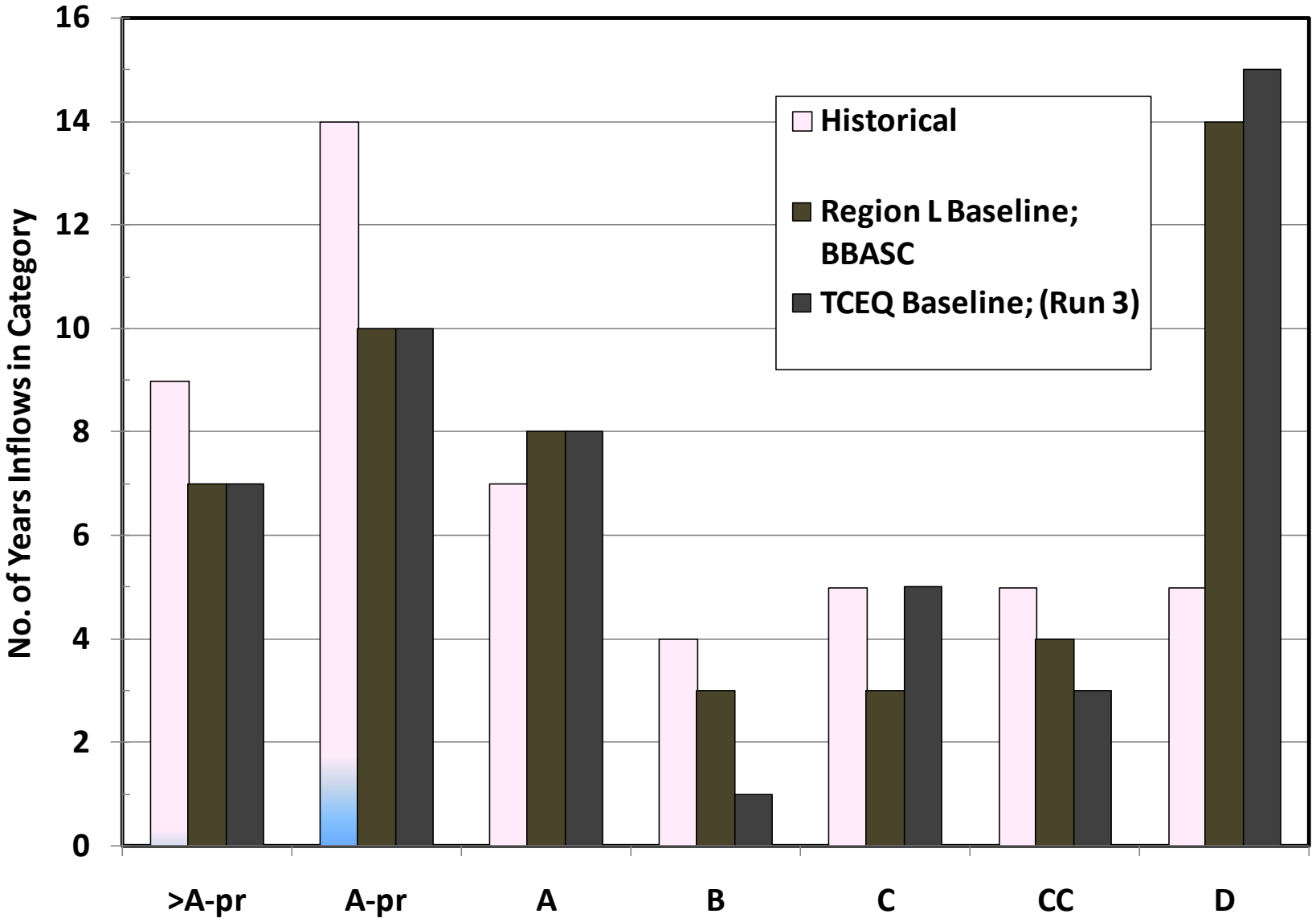

Guadalupe Estuary - Inflows under various scenarios
Inflow (1000 ac-ft/mon.)
100
90
80
70
60
50
40
30
20
10
0
Historical
Region L Baseline; BBASC
w. San Antonio Project
Jan - 1983
Feb
Mar
Apr
May
Jun - 1983
Jul
Aug
Sep
Oct
Nov
Dec - 1983
Jan - 1984
Feb
Mar
Apr
May
Jun - 1984
Jul
Aug
Sep
Oct
Nov
Dec - 1984


Guadalupe Estuary - Inflows under various scenarios
Inflow (1000 ac-ft/mon.)
400
350
300
250
200
150
100
50
0
Historical
Region L Baseline; BBASC
w. San Antonio Project
Jan - 1987
Mar
May
Jul
Sep
Nov
Jan - 1988
Mar
May
Jul
Sep
Nov
Jan - 1989
Mar
May
Jul
Sep
Nov

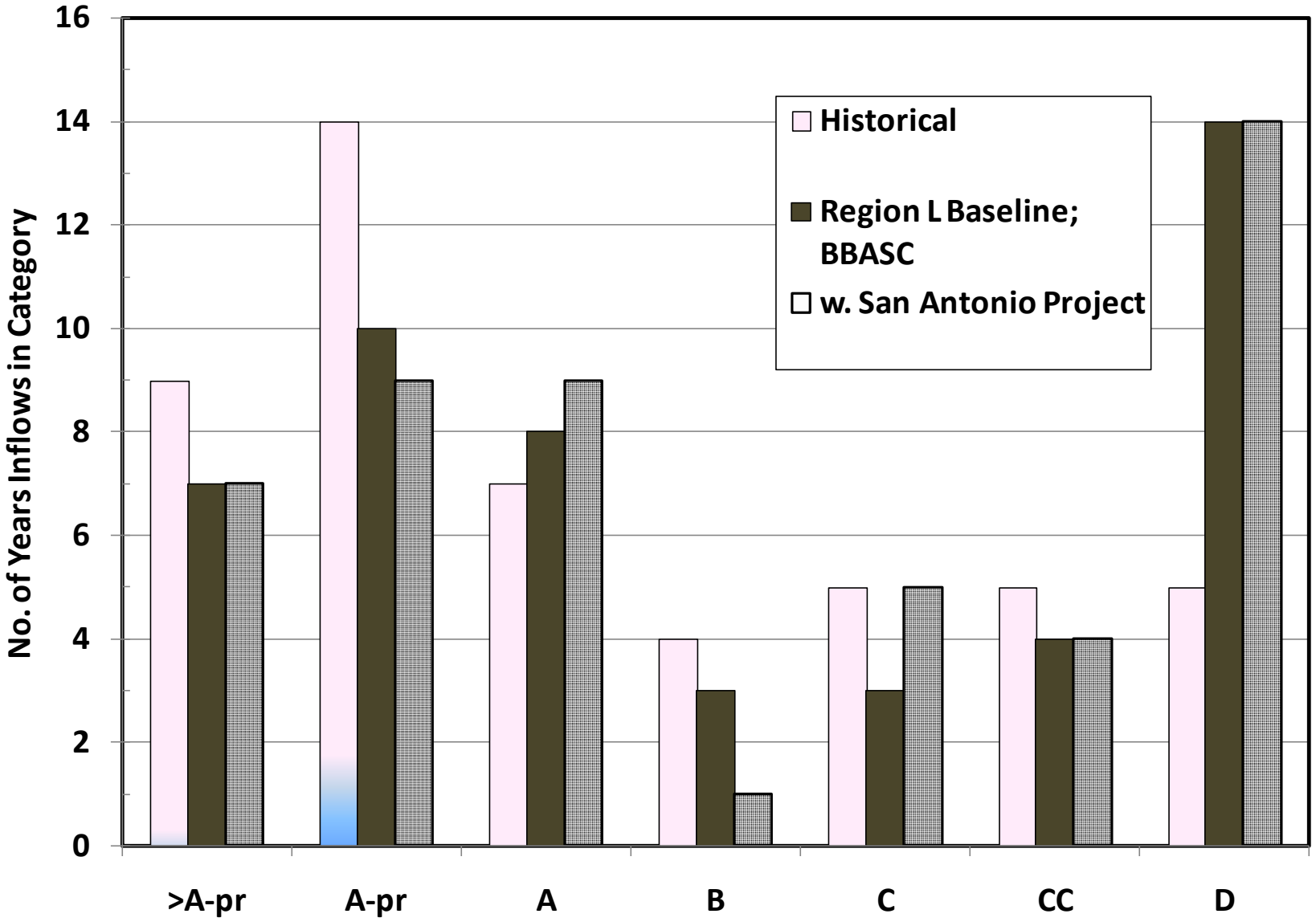

Guadalupe Estuary - Inflows under various scenarios
Inflow (1000 ac-ft/mon.)
100
90
80
70
60
50
40
30
20
10
0
Historical
Region L Baseline; BBASC
w. San Antonio Project
Jan - 1987
Mar
May
Jul
Sep
Nov
Jan - 1988
Mar
May
Jul
Sep
Nov
Jan - 1989
Mar
May
Jul
Sep
Nov


Guadalupe Estuary - Inflows under various scenarios
Inflow (1000 ac-ft/mon.)
100
90
80
70
60
50
40
30
20
10
0
Historical
Region L Baseline; BBASC
w. San Antonio Project
Jan - 1954
Mar
May
Jul
Sep
Nov
Jan - 1955
Mar
May
Jul
Sep
Nov
Jan - 1956
Mar
May
Jul
Sep
Nov

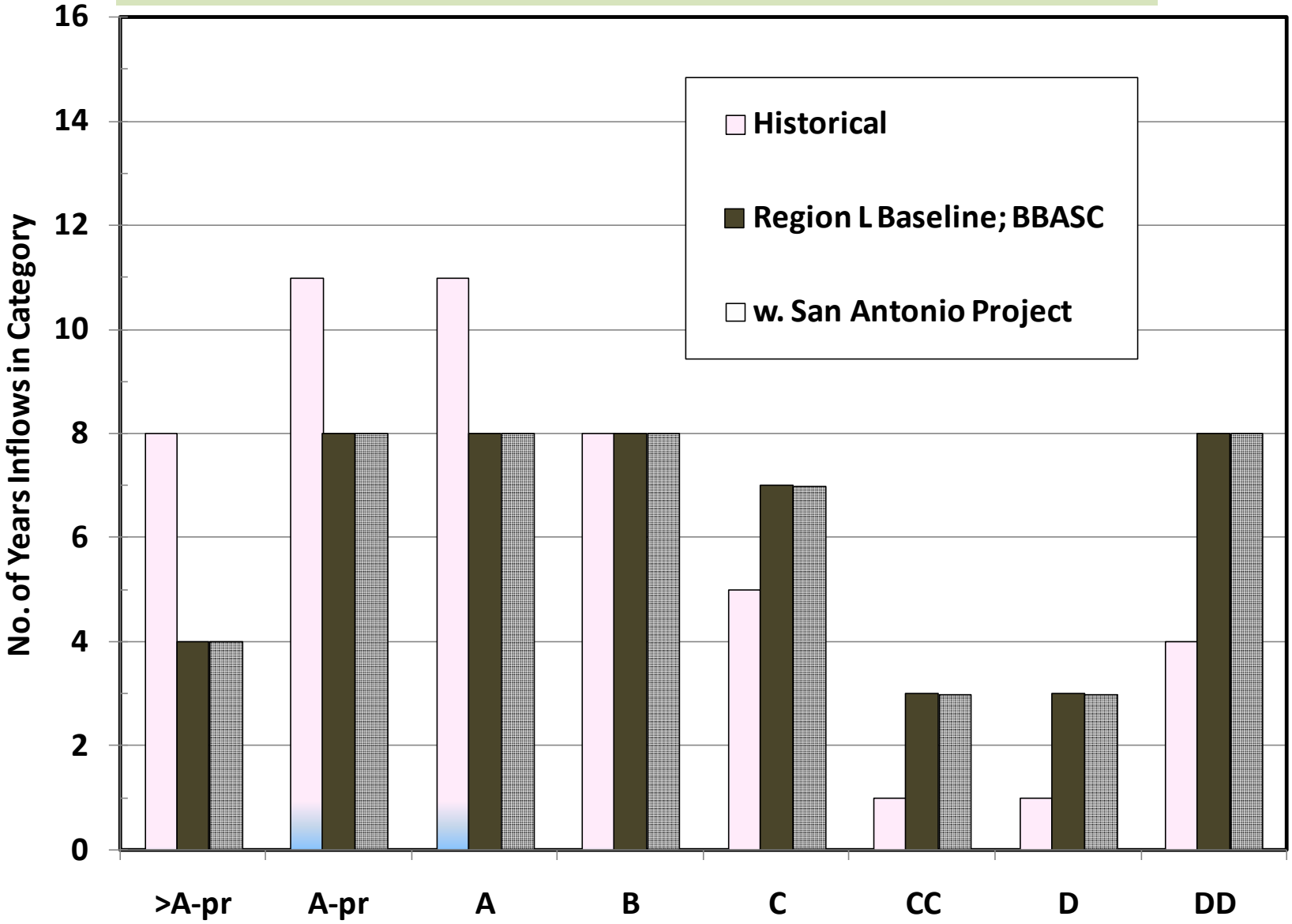
Guadalupe Estuary, Criteria Set G1 - Category Attainment 1941-89



Guadalupe Estuary, Criteria Set G1 - Category Attainment 1941-89



Guadalupe Estuary, Criteria Set G2 - Category Attainment 1941-89



Summary – Attainment of G1 Springtime Criteria (Rangia) with the San Antonio River Project

Counts	Criteria G1 Attainment (no. years)							
Scenario	>A-pr	A-pr	A	B	C	CC	D	sum
Historical	9	14	7	4	5	5	5	49
Present	8	14	4	5	5	5	8	49
Region L Baseline; BBASC	7	10	8	3	3	4	14	49
w. San Antonio Project	7	9	9	1	5	4	14	49
TCEQ Baseline; (Run 3)	7	10	8	1	5	3	15	49
see Tables 4.5-3 & 4.5-6		>12%	>12%				<=9%	

Attain. - Singles	Single G1 criteria attainment (% of yrs.)						
Scenario	>A-pr	A-pr	A	B	C	CC	D
Historical		28.6%	14.3%	8.2%	10.2%	10.2%	10.2%
Present		28.6%	8.2%	10.2%	10.2%	10.2%	16.3%
Region L Baseline; BBASC		20.4%	16.3%	6.1%	6.1%	8.2%	28.6%
w. San Antonio Project		18.4%	18.4%	2.0%	10.2%	8.2%	28.6%
TCEQ Baseline; (Run 3)		20.4%	16.3%	2.0%	10.2%	6.1%	30.6%
see Table 4.5-3			>17%		>=19%	<=2/3	

Attain. - Joints	Joint G1 criteria attainment (% of yrs. and fractions)						
Scenario	>A-pr		A & B		C & CC	frac. CC	
Historical			22.4%		20.4%	50.0%	
Present			18.4%		20.4%	50.0%	
Region L Baseline; BBASC			22.4%		14.3%	57.1%	
w. San Antonio Project			20.4%		18.4%	44.4%	
TCEQ Baseline; (Run 3)			18.4%		16.3%	37.5%	

Color coding convention
-OK, met criteria
-Near miss. (rounding; p-o-record)
-Not met, but departure not great
-Very bad

Summary – Attainment of G2 Summer Criteria (oysters) with the San Antonio River Project

Counts	Criteria G2 Attainment (no. years)								
Scenario	>A-pr	A-pr	A	B	C	CC	D	DD	sum
Historical	8	11	11	8	5	1	1	4	49
Present	5	11	8	10	8	1	1	5	49
Region L Baseline; BBASC	4	8	8	8	7	3	3	8	49
w. San Antonio Project	4	8	8	8	7	3	3	8	49
TCEQ Baseline; (Run 3)	4	6	9	8	6	4	3	9	49
see Tables 4.5-2; 4.5-4		>12%	>17%				<=6%		
Attain. - Singles	Single G2 criteria attainment (% of yrs.)								
Scenario	>A-pr	A-pr	A	B	C	CC	D	DD	
Historical		22.4%	22.4%	16.3%	10.2%	2.0%	2.0%	8.2%	
Present		22.4%	16.3%	20.4%	16.3%	2.0%	2.0%	10.2%	
Region L Baseline; BBASC		16.3%	16.3%	16.3%	14.3%	6.1%	6.1%	16.3%	
w. San Antonio Project		16.3%	16.3%	16.3%	14.3%	6.1%	6.1%	16.3%	
TCEQ Baseline; (Run 3)		12.2%	18.4%	16.3%	12.2%	8.2%	6.1%	18.4%	
see Table 4.5-2			>=30%		>10%	<=1/6	<=9%		
Attain. - Joints	Joint G2 criteria attainment (% of yrs. and fractions)								
Scenario	>A-pr		A & B		C & CC	frac. CC	D & DD		
Historical			38.8%		12.2%	16.7%	10.2%		
Present			36.7%		18.4%	11.1%	12.2%		
Region L Baseline; BBASC			32.7%		20.4%	30.0%	22.4%		
w. San Antonio Project			32.7%		20.4%	30.0%	22.4%		
TCEQ Baseline; (Run 3)			34.7%		20.4%	40.0%	24.5%		

Color coding convention	
	-OK, met criteria
	-Near miss. (rounding; p-o-record)
	-Not met, but departure not great
	-Very bad

Questions, Comments, & Discussion